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OBESITY PREVALENCE AMONG HEALTHCARE PROFESSIONALS IN ENGLAND: A CROSS-SECTIONAL STUDY USING THE HEALTH SURVEY FOR ENGLAND

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Title:
OBESITY PREVALENCE AMONG HEALTHCARE PROFESSIONALS IN ENGLAND: A CROSS-SECTIONAL STUDY USING THE HEALTH SURVEY FOR ENGLAND

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ABSTRACT

Objective: To estimate obesity prevalence among healthcare professionals in England and compare prevalence to those working in non-health related occupations.

Design: Cross-sectional study using five aggregated annual rounds (2008-2012) of the nationally representative Health Survey for England.

Setting: England.

Participants: 20,103 adults aged 17-65 indicating they were economically active at the time of survey classified into four occupational groups: nurses (n=422), other healthcare professionals (n=412), unregistered care workers (n=736) and individuals employed in non-health related occupations (n=18,533).

Outcome measure: Prevalence of obesity defined as Body Mass Index ≥ 30.0 .

Results: Obesity prevalence was high across all occupational groups including: among nurses (25.1% 95% CI 20.9, 29.4); other healthcare professionals (14.4% CI 11.0, 17.8); non-health related occupations (23.5% CI 22.9, 24.1); and unregistered care workers who had the highest prevalence of obesity (31.9%, CI 28.4, 35.3). A logistic regression model adjusted for socio-demographic composition and survey year indicated that, compared to nurses, the odds of being obese were significantly lower for other health care professionals (adjusted Odds Ratio [aOR] 0.52, CI 0.37, 0.75) and higher for unregistered care workers (aOR 1.46 CI 1.11, 1.93). There was no significant difference in obesity prevalence between nurses and people working in non-health related occupations (aOR 0.94 CI 0.74, 1.18).

Conclusions: High obesity prevalence among healthcare professionals is concerning, especially among nurses and unregistered care workers. Increasing reliance on unregistered healthcare staff may negatively impact on service delivery

and effectiveness. Further research is required to better understand the reasons for high obesity prevalence among healthcare professionals in England, and to inform interventions to support individuals to achieve and maintain a healthy weight.

Strengths and limitations of this study

- This is the first study to provide reliable estimates of the prevalence of obesity among healthcare professionals in England.
- Data were drawn from a nationally representative sample of the English population which enhances generalisability.
- Height and weight measurements used to derive BMI were taken by nurses rather than self-reported which enhances reliability.
- Findings establish evidence to support urgent action from NHS England to address high rates of obesity among nurses and the unregistered healthcare workforce.
- Heterogeneity of roles and fields of practice within the nursing workforce is masked by the inability to differentiate within the single occupational classification of nurses.

INTRODUCTION

The Department of Health has estimated that “it is likely” that half of the 1.4 million NHS England staff are overweight or obese, with “around 300,000 classified as obese...” (21%) and “...a further 400,000 as overweight” (29%) (1), and a study of Scottish nurses found that 69% are overweight or obese (2). NHS England Chief Executive Sir Simon Stevens has suggested that the health service should “put its own house in order” (3), and set an example to other employers by supporting its workforce to maintain a healthy weight through workplace initiatives (4). The expected role of healthcare professionals in “making every contact count” (5) may be challenged by the lack of credibility of public health messages delivered by obese healthcare professionals. Obesity among nurses raises particular concerns because the impact of obesity on an ageing nursing workforce (6) poses problems for the efficacy and sustainability of the healthcare system, especially concerning given the growing workforce shortfalls. The aim of this study was to estimate the prevalence of obesity among nurses and healthcare professionals in England, and compare prevalence to the general working population.

METHODS

Study Design and Participants

Analysis was conducted using the Health Survey for England (HSE), an annual nationally representative sample of the English population. The HSE is a stratified random probability sample of private households in England and is used to estimate prevalence of health conditions and disease risk factors, as well as to plan health services and monitor government performance against policy targets. Data collection from adults over the age of 16 is conducted using Computer-Assisted Personal

Interviewing by an interviewer in participants' homes. Interviews are followed by a visit from a specially trained nurse during which measurements, including height and weight are taken (7).

Five annual rounds of the HSE (2008-2012) were aggregated to ensure sufficient power to enable analysis. To increase comparability between occupational groups, analysis was restricted to participants aged 17-65 years old and who indicated they were economically active at the time of survey.

Measures

The four measures of obesity, occupation, gender and age were identified from the HSE.

Obesity

Nurses measured participants' height and weight during follow-up visits from which Body Mass Index (BMI) was derived. World Health Organisation (WHO) classifications were used in analysis: 'underweight' (BMI < 18.5), 'normal' (BMI = 18.5-24.9), 'overweight' (BMI = 25.0-29.9) and 'obese' (BMI ≥ 30). Due to small numbers of underweight participants in the sample, underweight and normal weight categories were aggregated into a single category for analysis.

Occupation

Survey participants were asked their occupation with responses recorded using free text of up to 60 characters. Free-text responses were then classified using the standard occupational classification (SOC2000 for survey years 2008-2011) and

SOC2010 (2012) to create a categorical variable (8). Occupations were aggregated into four separate groups: nurses, other health care professions; unregistered care workers; and non-health care occupations. Aggregating occupational categories ensured sufficient numbers to enable comparison. The specific codes used to create each of these occupational groups are shown in Table 1.

[Insert Table 1 here.]

Socio-demographic characteristics

Data on gender and age were used in analysis to take account of potential compositional differences between occupational groups. Using occupational categories for comparison will largely have self-adjusted for differences in socio-economic status.

Statistical Methods

Only participants with complete data were included in analysis as initial analysis identified no statistically significant difference in the likelihood of respondents in occupational groups having missing data relating to BMI ($p=0.86$). Prevalence of obesity was calculated for each occupational group with 95% Confidence Intervals (CI). Logistic regression models were then used to compare the odds of being obese or not obese between nurses and other occupational groups. First, the model was built using occupational group as the only predictor. Second, socio-demographic variables (i.e. gender and age) that might explain differences in prevalence between groups were entered into the model. Survey year was also included to take account of any potential temporal effects. Data were analysed using SAS 9.1.3 (SAS Institute, Inc., Cary NC, 2004). Weights supplied by NatCen were applied in analysis.

These weights increase the degree to which estimates are representative of the English population. Results are shown for weighted data.

RESULTS

Sample

After aggregating data across all five survey years, 66,283 individuals were included in the initial dataset. Including only those who aged 17-65 who indicated that they were working at the time of the survey and for whom occupation was recorded reduced the sample to 23,230. Removing the 3,127 (13.5%) people for whom BMI data were missing resulted in a final sample for analysis of 20,103 individuals.

The unweighted sample included 422 nurses (2.1%), 412 other healthcare professionals (2.0%), 736 unregistered care workers (3.7%), and 18,533 (92.2%) people in non-health related occupations (Table 2).

[Insert Table 2 here.]

Obesity prevalence

After weighting of data, prevalence of obesity (BMI \geq 30) among nurses was 25.12% (95% CI 20.88, 29.37). Prevalence of obesity was higher among nurses than other healthcare professionals (14.39% CI 11.00, 17.77) and people in non-health related occupations (23.51% CI 22.92, 24.10) but lower than among unregistered care workers, who had the highest prevalence among healthcare professionals (31.88%, CI 28.44. 35.32).

[Insert Table 3 here]

A logistic regression model adjusted for age, sex and survey year indicated that, compared to nurses, the odds of being obese were significantly lower for other health care professionals (adjusted Odds Ratio [aOR] 0.52, CI 0.37, 0.75), but higher for unregistered care workers (aOR 1.46 CI 1.11, 1.93). No statistically significant difference was observed in prevalence of obesity between nurses and people working in non-health related occupations (aOR 0.94 CI, 0.74, 1.18).

[Insert Table 4 here]

DISCUSSION

A quarter of nurses in England were obese (25.1%). This was lower compared to nurses in Australia (28.5%) (9), New Zealand (28.2%) (9), the United States of America (27.0%) (10), South Africa (51.6%) (11) and Scotland (29.4%) (2). There was no statistically significant difference between the prevalence of obesity among nurses and the general working population. Nurses are part of the societies that they serve and hence are influenced by the same wider social determinants of health that are driving increases in the prevalence of obesity. However, changes in the food system, including reductions in food preparation time, are thought to be one of the major drivers of the global obesity epidemic (12). This raises important concerns about the availability of healthy food in the workplace for nurses and healthcare professionals (13).

As in other developed countries, obesity tends to increase with age (up to 64 years) (14) and as almost half (47.1%) of English nurses are over the age of 45 (15), this poses a likely future burden of ill health for the health services workforce as it ages.

Prevalence of obesity in nurses in Scotland is greater than England (2), which may reflecting health inequalities across Great Britain. Prevalence of obesity among nurses was statistically significantly higher than among other healthcare professionals and significantly lower than unregistered care workers. Differences observed between nurses and unregistered care workers may reflect population-level inequalities in obesity prevalence, where obesity is more common in people with low educational attainment, low income or in manual occupations (12,16,17). However, observed differences between nurses and other healthcare professionals requires further examination in future research as many individuals in the other healthcare professionals group will be classified in same group of the 8-fold National Statistics Socio-Economic Classification (NS-SEC) (i.e., group 2 - lower managerial and professional) as nurses (8).

Implications for policy and practice

These findings have important implications for the health of the health and social care workforce, the effectiveness of health promotion delivered by healthcare professionals, and patient safety.

Given the established link between obesity and increased risk of illness and injury, obesity among healthcare professionals potentially harms their health. Workforce capacity may be reduced through increased absenteeism and premature workforce exit (18). Together these two factors could increase the cost of service delivery considerably through sickness absence payments for existing staff, increased salary costs of temporary (agency) staff, increased training costs to replace staff, and the attendant loss of experience and expertise.

Second, obesity may hamper the efficacy of healthcare professionals' health promotion efforts. As the largest professional group within healthcare systems both in the UK and internationally, nurses, in particular, have been encouraged to seize 'teachable moments' during routine care to educate and encourage patients to make positive changes to their behaviour (19) and the NHS Standard Contract (5) states that "staff use every contact that they have with Service Users and the public as an opportunity to maintain or improve health and wellbeing." Indeed, a recent survey of attitudes towards obesity in the UK reported that 60% of people believed that healthcare professionals were responsible for reducing obesity, second only to individuals who are obese themselves (20) and a recent Delphi study concluded that role modelling healthy behaviours was a reasonable professional expectation of nurses (21). Yet a systematic review of the impact of personal health behaviours on health promotion practice found that patients are more likely to accept advice offered by a visibly healthy healthcare professional compared to a healthcare professional who is overweight or obese (22), and there is evidence that healthcare professionals' lifestyle behaviours influence the frequency and willingness with which they offer health advice (23,24).

Third, and perhaps more controversially, obesity among healthcare professionals may hinder effective patient care through performance impairments that impact on patient safety. Obese individuals may struggle with health issues associated with obesity, including fatigue, breathlessness, or arthritis which could reduce productivity in the workplace (25). Nurses who are obese may struggle to perform nursing tasks such as cardiopulmonary resuscitation (CPR), moving and handling, and attending to

patients’ personal care needs due to limited space in washrooms (26). Performing certain physical aspects of the nursing role while obese may further harm healthcare professionals’ health or increase the likelihood of injury, potentially leading to sickness absence or workforce exit. More research is required to assess the impact of obesity on nurses’ ability to physically and mentally perform their role.

This research has important implications for approaches to service design and workforce realignment, especially in the content of expanded roles for unregistered care workers in England (27) who were found to have the highest prevalence of overweight and obesity in our study. Urgent action from NHS England, involving Occupational Health (OH) and Human Resources (HR) departments across Trusts, is required to “put its own house in order” and reduce the prevalence of obesity among healthcare professionals that was found to be higher than published Department of Health estimates (1). Only through such concerted effort will the health service in England prevent the potentially harmful effects that high levels of obesity may have on patient care, the sustainability of the health service and – most importantly – the individual health of those who work within it.

Strengths and limitations

This is the first study to use the Health Survey for England to estimate prevalence of obesity among healthcare professionals. Data were drawn from a nationally representative sample of the English population which enhances generalisability. The height and weight measurements used to derive BMI were taken by nurses rather than self-reported which enhances reliability. However, the study does have several limitations. First, BMI data for some participants (13.5%) were missing, although there was no statistically significant difference in the extent of missing data

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2
3 between occupational groups ($p=0.86$). Second, heterogeneity of roles and fields of
4
5 practice within the nursing workforce is masked by the inability to differentiate within
6
7 the single occupational classification of nurses. Third, there was no question about
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9 parental socio-economic status that might have enabled analysis of social mobility in
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11 contrast to work done elsewhere on nurses and weight that drew on the Scottish
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13 Health Survey (2). Fourth, ethnicity might also partially account for the high rates of
14
15 obesity: obesity rates are 9% higher in Black women relative to White women and
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17 nearly 10% of the qualified nursing workforce identifies as Black or Black British (15)
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19 but the numbers included in the HSE were too small for confident analysis and to
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21 protect anonymity. Finally, for similar reasons it was not possible to investigate the
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23 responses of individuals to questions asked in the HSE about weight perceptions
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25 and intentions to lose weight and their measured BMI (28).
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33 CONCLUSIONS

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35 A quarter of nurses in England were obese ($BMI \geq 30$). Prevalence of obesity
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37 among nurses was statistically significantly higher than other healthcare
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39 professionals, but significantly lower than unregistered care workers. There was no
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41 statistically significant difference between levels of obesity among nurses and the
42
43 general working population. Obesity among healthcare professionals has potentially
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45 negative implications for the capacity, efficacy, sustainability and safety of healthcare
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47 services and the health of healthcare professionals. Further research is required to
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49 better understand the reasons for high levels of obesity among healthcare
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51 professionals, especially nurses and unregistered care workers. Urgent action is
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53 required to support healthcare professionals to achieve and maintain a healthy
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55 weight.
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Contributors

RGK, IMA, JW designed the study. IMA conducted data analysis. RGK wrote the first draft of the manuscript and IMA, JW, CM, LH, MK revised the manuscript for important intellectual content. All authors approved the final version.

Conflict of interest statement

The authors confirm that there are no known conflicts of interest associated with this publication.

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Ethics committee approval

The study was reviewed and approved by the Research Ethics Committee in the University [anonymised for peer review].

Data sharing statement

Health Survey for England data are available from NatCen Social Research.

REFERENCES

1. Cross-Government Obesity Unit. Healthy weight, healthy lives: One year on. London, UK: HM Government; 2009.
2. Kyle RG, Neall RA, Atherton IM. Prevalence of overweight and obesity among nurses in Scotland: A cross-sectional study using the Scottish Health Survey. *Int J Nurs Stud*. Elsevier Ltd; 2016;53:126–33.
3. Stevens S. Simon Stevens announces major drive to improve health in NHS workplace. London, UK: NHS England; 2015.
4. Stevens S. Get serious about obesity or bankrupt the NHS [Internet]. NHS England. 2014. Available from: <https://www.england.nhs.uk/2014/09/serious-about-obesity/>
5. NHS England. NHS Standard Contract 2017/18 and 2018/19 Service Conditions. London, UK: NHS England; 2016.
6. Sherman RO, Chiang-Hanisko L, Koszalinski R. The ageing nursing workforce: a global challenge. *J Nurs Manag*. 2013 Oct;21(7):899–902.
7. NatCen Social Research and UCL. Health Survey for England 2015. Methods. London, UK National Centre for Social Research; 2016.
8. Rose D, Pevalin D, O'Reilly K. The National Statistics Socio-economic Classification: Origins, Development and Use. Basingstoke, UK: Palgrave Macmillan; 2005.
9. Bogossian FE, Hepworth J, Leong GM, Flaws DF, Gibbons KS, Benefer C a., et al. A cross-sectional analysis of patterns of obesity in a cohort of working nurses and midwives in Australia, New Zealand, and the United Kingdom. *Int J Nurs Stud*. Elsevier Ltd; 2012;49(6):727–38.
10. Zitkus BS. The relationship among registered nurses' weight status, weight

loss regimens, and successful or unsuccessful weight loss. *J Am Acad Nurse Pract.* 2011 Feb;23(2):110–6.

11. Goon D, Maputle MS, Olukoga A, Lebeso R, Khoza LB, Ayanwu FC. Overweight, obesity and underweight in nurses in Vhembe and Capricorn districts, Limpopo. *South African J Clin Nutr.* 2013;26(3):147–9.

12. Swinburn BA, Sacks G, Hall KD, McPherson K, Finegood DT, Moodie ML, et al. The global obesity pandemic: shaped by global drivers and local environments. *Lancet.* 2011;378(9793):804–14.

13. Department of Health. The Hospital Food Standards Panel’s report on standards for food and drink in NHS hospitals. London, UK: Department of Health; 2014.

14. Hulsege G, Herber-Gast G-CM, Spijkerman AMW, Susan H, Picavet J, van der Schouw YT, et al. Obesity and Age-Related Changes in Markers of Oxidative Stress and Inflammation Across Four Generations. *Obesity.* 2016 Jun;24(6):1389–96.

15. NHS Digital. HCHS staff in NHS Trusts and CCGs in England, Equality and Diversity Tables, March 2016. London, UK: NHS Digital; 2016.

16. Loring B, Robertson A. Obesity and inequities: guidance for addressing inequities in overweight and obesity. Copenhagen: World Health Organisation, Regional Office for Europe; 2014.

17. Moody A, Neave A. Health Survey for England 2015. Adult overweight and obesity. London, UK: NHS Digital; 2016.

18. Kouwenhoven-Pasmooij TA, Burdorf A, Roos-Hesselink JW, Hunink MGM, Robroek SJW. Cardiovascular disease, diabetes and early exit from paid employment in Europe; the impact of work-related factors. *Int J Cardiol.* 2016

- Jul 15;215:332–7.
19. Marshall LC. Teachable moments. *Nurs Manage*. 2016 May;23(2):13.
 20. Curtice J. Attitudes to obesity. Findings from the 2015 British Social Attitudes survey. London, UK: Public Health England; 2016.
 21. Kelly M, Wills J, Jester R, Speller V. Should nurses be role models for healthy lifestyles? Results from a modified Delphi study. *J Adv Nurs*. 2017 Mar;73(3):665–78.
 22. Kelly M, Sykes S, Wills J. Do healthcare professionals' own health behaviours impact on patient outcomes? A systematic review. 2017;
 23. Fie S, Norman IJ, While AE. The relationship between physicians' and nurses' personal physical activity habits and their health-promotion practice: A systematic review. *Health Educ J*. 2012 Jan 11;72(1):102–19.
 24. Lobelo F, de Quevedo IG. The Evidence in Support of Physicians and Health Care Providers as Physical Activity Role Models. *Am J Lifestyle Med*. 2016 Jan 1;10(1):36–52.
 25. Finkelstein EA, Linnan LA, Tate DF, Leese PJ. A longitudinal study on the relationship between weight loss, medical expenditures, and absenteeism among overweight employees in the WAY to Health study. *J Occup Environ Med. Health Services and Systems Research Program, Duke NUS Graduate Medical School, Singapore*. 2009 Dec;51(12):1367–73.
 26. Krussig K, Willoughby D, Parker V, Ross P. Obesity Among Nurses: Prevalence and Impact on Work. *Am J Nurse Pract*. 2012;16(7/8):14–21.
 27. Health Education England. Nursing Associate - a new support role for nursing [Internet]. 2016 [cited 2017 Jun 6]. Available from: <http://tinyurl.com/zqbmeko>

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28. Robinson, E. and Oldham, M., 2016. Weight status misperceptions among UK adults: the use of self-reported vs. measured BMI. *BMC Obesity*, 3(1), .21.

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TABLES

Table 1: SOC2000 and SOC2010 codes for occupational groups.

Occupational Group	Occupational Classification Scheme (Survey Year)	
	SOC2000 (2008-2011)	SOC2010 (2012)
Nurses	3211	2231
Other healthcare professionals		
Medical practitioner	2211	2211
Psychologists	2212	2212
Pharmacists	2213	2213
Ophthalmic opticians	2214	2214
Dental practitioners	2215	2215
Medical radiographers	3214	2217
Podiatrists	3215	2218
Physiotherapists	3221	2221
Occupational therapists	3222	2222
Speech and language therapists	3223	2223
Therapy professionals n.e.c. ¹	3229	2229
Midwives	3212	2232
Unregistered care workers		
Nursing auxiliaries and assistants	6111	6141
Care assistants and home carers	6115	n/a
Care workers and home carers	n/a	6145
Senior care workers	n/a	6146
Non-health occupations		
All other codes	All other codes	All other codes

Note: ¹ n.e.c. = not elsewhere classified.

Table 2: Sample socio-demographic characteristics

	Nurses (n=422)		Other healthcare professionals (n=412)		Unregistered care workers (n=736)		Non-health occupations (n=18,533)		Total (n=20,103)	
	n	%	n	%	n	%	n	%	n	%
Survey										
2008	147	34.83	129	31.31	231	31.39	6526	35.21	7033	34.98
2009	41	9.72	38	9.22	59	8.02	1971	10.64	2109	10.49
2010	87	20.62	93	22.57	145	19.70	3336	18.00	3661	18.21
2011	79	18.72	79	19.17	157	21.33	3450	18.62	3765	18.73
2012	68	16.11	73	17.72	144	19.57	3250	17.54	3535	17.58
Gender										
Male	47	11.14	109	26.46	94	12.77	9660	52.12	9910	49.30
Females	375	88.86	303	73.54	642	87.23	8873	47.88	10193	50.70
Age										
≤29	46	10.9	71	17.23	128	17.39	3299	17.8	3544	17.63
30-34	38	9	54	13.11	78	10.6	2056	11.09	2226	11.07
35-39	56	13.27	53	12.86	74	10.05	2296	12.39	2479	12.33
40-44	72	17.06	62	15.05	101	13.72	2727	14.71	2962	14.73
45-49	90	21.33	64	15.53	107	14.54	2553	13.78	2814	14.00
50-54	55	13.03	48	11.65	96	13.04	2230	12.03	2429	12.08
55-59	47	11.14	41	9.95	82	11.14	1916	10.34	2086	10.38
≥60	18	4.27	19	4.61	70	9.51	1456	7.86	1563	7.77
BMI										
Mean (standard deviation)	27.26	(5.20)	25.91	(4.71)	28.35	(6.23)	27.19	(5.03)	27.21	(5.08)
<25.00 ¹	163	38.63	200	48.54	239	32.47	6801	36.70	7403	36.83
25.00-29.99	150	35.55	148	35.92	263	35.73	7279	39.28	7840	39.00
≥30.00	109	25.83	64	15.53	234	31.79	4453	24.03	4860	24.18

Note: ¹ Underweight included with normal weight due to small numbers.

Table 3: Overweight by occupational group

Occupational group	Obese (BMI \geq 30.00)			Overweight (BMI \geq 25.00)		
	Weighted			Weighted		
	%	95% CI		%	95% CI	
		Lower	Upper		Lower	Upper
Nurses	25.12	20.88	29.37	60.79	56.02	65.57
Other healthcare professionals	14.39	11.00	17.77	49.00	44.18	53.82
Unregistered care staff	31.88	28.44	35.32	68.12	64.67	71.56
Non-health related occupations	23.51	22.92	24.10	62.54	61.86	63.21

Table 4: Binary logistic regression models

	Obese (BMI ≥ 30.00)			
	Unweighted		Weighted	
	Unadjusted	Adjusted	Unadjusted	Adjusted
Occupational groups				
Nurse	Comparison	Comparison	Comparison	Comparison
Other health care professionals	0.53 (0.37-0.75)*	0.55 (0.39-0.77)*	0.50 (0.35-0.72)*	0.52 (0.37-0.75)*
Unregistered care staff	1.34 (1.02-1.75)*	1.40 (1.07-1.83)*	1.40 (1.06-1.84)*	1.46 (1.11-1.93)*
Non-health occupations	0.91 (0.73-1.13)	0.92 (0.73-1.15)	0.92 (0.73-1.15)	0.94 (0.74-1.18)
Survey year				
2008	Comparison	Comparison	Comparison	Comparison
2009	0.96 (0.85-1.07)	0.95 (0.85-1.07)	0.91 (0.81-1.02)	0.91 (0.81-1.02)
2010	1.11 (1.01-1.22)*	1.10 (1.00-1.20)	1.11 (1.02-1.21)*	1.10 (1.01-1.21)*
2011	0.97 (0.88-1.07)	0.96 (0.88-1.06)	0.95 (0.86-1.04)	0.93 (0.85-1.02)
2012	0.95 (0.87-1.05)	0.94 (0.85-1.03)	0.96 (0.87-1.05)	0.94 (0.86-1.03)
Gender				
Male	Comparison	Comparison	Comparison	Comparison
Female	0.92 (0.86-0.98)*	1.21 (1.05-1.39)*	0.93 (0.87-0.99)*	0.90 (0.84-0.96)*
Age				
≤29	Comparison	Comparison	Comparison	Comparison
30-34	1.21 (1.05-1.39)*	1.21 (1.05-1.39)*	1.26 (1.10-1.43)*	1.26 (1.10-1.43)*
35-39	1.65 (1.45-1.88)*	1.66 (1.45-1.89)*	1.78 (1.57-2.01)*	1.78 (1.58-2.02)*
40-44	1.74 (1.54-1.97)*	1.74 (1.54-1.97)*	1.83 (1.63-2.05)*	1.83 (1.63-2.05)*
45-49	2.10 (1.86-2.38)*	2.11 (1.87-2.39)*	2.30 (2.04-2.58)*	2.30 (2.05-2.59)*
50-54	2.32 (2.04-2.63)*	2.32 (2.04-2.63)*	2.54 (2.26-2.86)*	2.54 (2.25-2.86)*
55-59	2.43 (2.14-2.77)*	2.43 (2.13-2.77)*	2.55 (2.24-2.89)*	2.55 (2.25-2.90)*
≥60	2.21 (1.92-2.55)*	2.18 (1.89-2.51)*	2.33 (2.02-2.68)*	2.31 (2.00-2.66)*

Note: * p<0.05

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract	1, 2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2,3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	4
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	5-6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5-6
Bias	9	Describe any efforts to address potential sources of bias	6
Study size	10	Explain how the study size was arrived at	7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-7
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	6-7
		(b) Describe any methods used to examine subgroups and interactions	6-7
		(c) Explain how missing data were addressed	6-7
		(d) If applicable, describe analytical methods taking account of sampling strategy	6-7
		(e) Describe any sensitivity analyses	6-7
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7
		(b) Give reasons for non-participation at each stage	7
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	7, 19
		(b) Indicate number of participants with missing data for each variable of interest	7
Outcome data	15*	Report numbers of outcome events or summary measures	7-8
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	20
		(b) Report category boundaries when continuous variables were categorized	5-6
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	8
Discussion			
Key results	18	Summarise key results with reference to study objectives	8
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	11-12
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	9-11
Generalisability	21	Discuss the generalisability (external validity) of the study results	9-11
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	13

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

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OBESITY PREVALENCE AMONG HEALTHCARE PROFESSIONALS IN ENGLAND: A CROSS-SECTIONAL STUDY USING THE HEALTH SURVEY FOR ENGLAND

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Title:
OBESITY PREVALENCE AMONG HEALTHCARE PROFESSIONALS IN ENGLAND: A CROSS-SECTIONAL STUDY USING THE HEALTH SURVEY FOR ENGLAND

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ABSTRACT

Objective: To estimate obesity prevalence among healthcare professionals in England and compare prevalence to those working outside of the health services.

Design: Cross-sectional study based on data from five years (2008-2012) of the nationally representative Health Survey for England.

Setting: England.

Participants: 20,103 adults aged 17-65 indicating they were economically active at the time of survey classified into four occupational groups: nurses (n=422), other healthcare professionals (n=412), unregistered care workers (n=736) and individuals employed in non-health related occupations (n=18,533).

Outcome measure: Prevalence of obesity defined as Body Mass Index ≥ 30.0 with 95% confidence intervals (CI) and weighted to reflect the population.

Results: Obesity prevalence was high across all occupational groups including: among nurses (25.1% 95% CI 20.9, 29.4); other healthcare professionals (14.4% CI 11.0, 17.8); non-health related occupations (23.5% CI 22.9, 24.1); and unregistered care workers, who had the highest prevalence of obesity (31.9%, CI 28.4, 35.3). A logistic regression model adjusted for socio-demographic composition and survey year indicated that, compared to nurses, the odds of being obese were significantly lower for other health care professionals (adjusted Odds Ratio [aOR] 0.52, CI 0.37, 0.75) and higher for unregistered care workers (aOR 1.46 CI 1.11, 1.93). There was no significant difference in obesity prevalence between nurses and people working in non-health related occupations (aOR 0.94 CI 0.74, 1.18).

Conclusions: High obesity prevalence among nurses and unregistered care workers is concerning as it increases the risks of musculoskeletal conditions and mental health conditions which are the main causes of sickness-absence in health

services. Further research is required to better understand the reasons for high obesity prevalence among healthcare professionals in England to inform interventions to support individuals to achieve and maintain a healthy weight.

Strengths and limitations of this study

- This is the first study to provide reliable estimates of the prevalence of obesity among healthcare professionals in England.
- Data were drawn from a nationally representative sample of the English population which enhances generalisability.
- Height and weight measurements used to derive BMI were taken by nurses rather than self-reported which enhances reliability.
- Findings establish evidence to support urgent action from NHS England to address high rates of obesity among nurses and the unregistered healthcare workforce.
- Heterogeneity of roles and fields of practice within the nursing workforce is masked by the inability to differentiate within the single occupational classification of nurses.

INTRODUCTION

Obesity is linked to increased risk of developing a range of life-limiting illnesses, including heart disease (1), cancer (2), and type 2 diabetes (3). It is known to increase the likelihood of lower back injury (4), and has been associated with reduced quality of life (5). The World Health Organisation (WHO) has estimated that between 2% and 7% of healthcare spending in developed economies can be attributed to obesity (6). In the United Kingdom (UK) government spending on the direct medical costs of obesity is currently £6 billion, equivalent to 5% of the National Health Service (NHS) budget, and is estimated to double by 2030 (6).

Prevalence of obesity in the UK ranks third highest in Western Europe after Malta and Iceland with a quarter of UK adults being obese (7). In England, 27% of both men and women are obese (8), and 60% of men and 50% of women are predicted to be obese by 2050 (9). Prevalence of obesity among healthcare professionals in England is not known, although the Department of Health in England has estimated that 300,000 healthcare professionals can be classified as obese (21%) (10) and these figures are likely to have risen in line with population trends. A study in Scotland found that 29% of nurses, 17% of other healthcare professionals (including doctors, pharmacists, dentists and therapy professionals), and 35% of unregistered care workers were obese (11). Several studies of the health of healthcare professionals have found that a significant proportion are obese (12–14) and a study of nearly 5000 nurses and midwives registered in Australia, New Zealand or the UK found that nurses and midwives have higher prevalence of obesity and overweight than the general population (15).

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It is important to be able to have an accurate assessment of the prevalence of obesity among healthcare professionals for three main reasons. Firstly, obesity increases the likelihood of musculoskeletal disorders (16) and mental health conditions (17,18), which are the leading causes of work-related illness and workplace injury for healthcare professionals (19). As well as being implicated in the onset of chronic diseases, these conditions and their associated sickness-absence rates pose a potential problem for the efficacy and sustainability of the healthcare system by potentially reducing the capacity of the healthcare workforce.

Secondly, comparing obesity rates in different healthcare professional groups and with the general population will help to identify the possible contribution of adverse workplace factors such as a lack of access to healthy food options (20), shift working (21–23) and a possible link between obesity and high demand/low control work (24,25) to increasing obesity among healthcare professionals (24).

Thirdly, widespread obesity among the workforce may hamper the efficacy of healthcare professionals' health promotion efforts. As the largest professional group within healthcare systems both in the UK and internationally (26,27), nurses, in particular, have been encouraged to seize 'teachable moments' during routine care to educate and encourage patients to make positive changes to their behaviour (28). The NHS Standard Contract (29, p.12) states that "staff use every contact that they have with Service Users and the public as an opportunity to maintain or improve health and wellbeing." Indeed, a recent survey of attitudes towards obesity in the UK reported that 60% of people believed that healthcare professionals were responsible for reducing obesity, second only to individuals who are obese themselves (30). Role

modelling healthy behaviours is seen as a reasonable professional expectation of nurses (31). A systematic review of the impact of personal health behaviours on health promotion practice found that patients are more likely to accept advice offered by a visibly healthy healthcare professional compared to a healthcare professional who is overweight or obese (32), and there is evidence that healthcare professionals' lifestyle behaviours influence the frequency and willingness with which they offer health advice (33,34).

The aim of this study was to estimate the prevalence of obesity among nurses and healthcare professionals in England, and compare prevalence to the general working population.

METHODS

Study Design and Participants

Analysis was conducted using the Health Survey for England (HSE), an annual nationally representative sample of the English population. The HSE is a stratified random probability sample of private households in England and is used to estimate prevalence of health conditions and disease risk factors, as well as to plan health services and monitor government performance against policy targets. Data collection from adults over the age of 16 is conducted using Computer-Assisted Personal Interviewing by an interviewer in participants' homes. Interviews are followed by a visit from a specially trained nurse during which measurements, including height and weight are taken and the methods for collection are published elsewhere (35).

Five annual rounds of the HSE (2008-2012) were aggregated to ensure sufficient power to enable analysis. To increase comparability between occupational groups, analysis was restricted to participants aged 17-65 years old and who indicated they were economically active at the time of survey.

Measures

The four measures of obesity, occupation, gender and age were identified from the HSE. Each measure is discussed in turn.

Obesity

Nurses measured participants' height and weight during follow-up visits from which Body Mass Index (BMI) was derived. World Health Organisation (WHO) classifications were used in analysis: 'underweight' (BMI < 18.5), 'normal' (BMI = 18.5-24.9), 'overweight' (BMI = 25.0-29.9) and 'obese' (BMI ≥ 30). Due to small numbers of underweight participants in the sample, underweight and normal weight categories were aggregated into a single category for analysis.

Occupation

Survey participants were asked their occupation with responses recorded using free text of up to 60 characters. Free-text responses were then classified using the standard occupational classification (SOC2000 for survey years 2008-2011) and SOC2010 (2012) to create a categorical variable (36). Occupations were aggregated into four separate groups: nurses, other health care professionals; unregistered care workers; and non-health care occupations. Aggregating occupational categories

ensured sufficient numbers to enable comparison. The specific codes used to create each of these occupational groups are shown in Table 1.

Table 1: SOC2000 and SOC2010 codes for occupational groups.

Occupational Group	Occupational Classification Scheme (Survey Year)	
	SOC2000 (2008-2011)	SOC2010 (2012)
Nurses	3211	2231
Other healthcare professionals		
Medical practitioner	2211	2211
Psychologists	2212	2212
Pharmacists	2213	2213
Ophthalmic opticians	2214	2214
Dental practitioners	2215	2215
Medical radiographers	3214	2217
Podiatrists	3215	2218
Physiotherapists	3221	2221
Occupational therapists	3222	2222
Speech and language therapists	3223	2223
Therapy professionals n.e.c. ¹	3229	2229
Midwives	3212	2232
Unregistered care workers		
Nursing auxiliaries and assistants	6111	6141
Care assistants and home carers	6115	n/a
Care workers and home carers	n/a	6145
Senior care workers	n/a	6146
Non-health occupations		
All other codes	All other codes	All other codes

Note: ¹ n.e.c. = not elsewhere classified.

Socio-demographic characteristics

Data on gender and age were used in analysis to take account of potential compositional differences between occupational groups. Gender was selected as a covariate because there is a considerable gender imbalance in the English nursing workforce towards female registrants. Age was included to account for different age compositions in each of the occupational comparison groups. The age cut-off of 17 years was used as 17 is the earliest point at which student nurses can enter practice. Using occupational categories for comparison will largely have self-adjusted for differences in socio-economic status.

Statistical Methods

Only participants with complete data were included in analysis as initial analysis identified no statistically significant difference in the likelihood of respondents in occupational groups having missing data relating to BMI ($p=0.86$). Prevalence of obesity was calculated for each occupational group with 95% Confidence Intervals (CI). Logistic regression models were then used to compare the odds of being obese or not obese between nurses and other occupational groups. First, the model was built using occupational group as the only predictor. Second, socio-demographic variables (i.e. gender and age) that might explain differences in prevalence between groups were entered into the model. Survey year was also included to take account of any potential temporal effects. Data were analysed using SAS 9.1.3 (SAS Institute, Inc., Cary NC, 2004). Weights supplied by NatCen were applied in analysis (35). These weights increase the degree to which estimates are representative of the English population and adjust the sample to reduce bias from individual non-response within households. Results are shown for weighted data.

RESULTS

Sample

After aggregating data across all five survey years, 66,283 individuals were included in the initial dataset. Including only those aged 17-65 who indicated that they were working at the time of the survey and for whom occupation was recorded reduced the sample to 23,230. Removing the 3,127 (13.5%) people for whom BMI data were missing resulted in a final sample for analysis of 20,103 individuals.

The unweighted sample included 422 nurses (2.1%), 412 other healthcare professionals (2.0%), 736 unregistered care workers (3.7%), and 18,533 (92.2%) people in non-health related occupations (Table 2).

Obesity prevalence

After weighting of data, prevalence of obesity ($\text{BMI} \geq 30$) among nurses was 25.12% (95% CI 20.88, 29.37) (Table 3). Prevalence of obesity was higher among nurses than other healthcare professionals (14.39% CI 11.00, 17.77) and people in non-health related occupations (23.51% CI 22.92, 24.10) but lower than among unregistered care workers, who had the highest prevalence among healthcare professionals (31.88%, CI 28.44, 35.32). A similar pattern was observed for being overweight ($\text{BMI} \geq 25$) (Table 3).

A logistic regression model adjusted for age, sex and survey year indicated that, compared to nurses, the odds of being obese were significantly lower for other health care professionals (adjusted Odds Ratio [aOR] 0.52, CI 0.37, 0.75), but higher for unregistered care workers (aOR 1.46 CI 1.11, 1.93) (Table 4). No statistically

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significant difference was observed in prevalence of obesity between nurses and people working in non-health related occupations (aOR 0.94 CI, 0.74, 1.18).

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Table 2: Sample socio-demographic characteristics

	Nurses (n=422)		Other healthcare professionals (n=412)		Unregistered care workers (n=736)		Non-health occupations (n=18,533)		Total (n=20,103)	
	n	%	n	%	n	%	n	%	n	%
Survey										
2008	147	34.83	129	31.31	231	31.39	6526	35.21	7033	34.98
2009	41	9.72	38	9.22	59	8.02	1971	10.64	2109	10.49
2010	87	20.62	93	22.57	145	19.70	3336	18.00	3661	18.21
2011	79	18.72	79	19.17	157	21.33	3450	18.62	3765	18.73
2012	68	16.11	73	17.72	144	19.57	3250	17.54	3535	17.58
Gender										
Male	47	11.14	109	26.46	94	12.77	9660	52.12	9910	49.30
Females	375	88.86	303	73.54	642	87.23	8873	47.88	10193	50.70
Age										
≤29	46	10.9	71	17.23	128	17.39	3299	17.8	3544	17.63
30-34	38	9	54	13.11	78	10.6	2056	11.09	2226	11.07
35-39	56	13.27	53	12.86	74	10.05	2296	12.39	2479	12.33
40-44	72	17.06	62	15.05	101	13.72	2727	14.71	2962	14.73
45-49	90	21.33	64	15.53	107	14.54	2553	13.78	2814	14.00
50-54	55	13.03	48	11.65	96	13.04	2230	12.03	2429	12.08
55-59	47	11.14	41	9.95	82	11.14	1916	10.34	2086	10.38
≥60	18	4.27	19	4.61	70	9.51	1456	7.86	1563	7.77
BMI										
Mean (standard deviation)	27.26	(5.20)	25.91	(4.71)	28.35	(6.23)	27.19	(5.03)	27.21	(5.08)
<25.00 ¹	163	38.63	200	48.54	239	32.47	6801	36.70	7403	36.83
25.00-29.99	150	35.55	148	35.92	263	35.73	7279	39.28	7840	39.00
≥30.00	109	25.83	64	15.53	234	31.79	4453	24.03	4860	24.18

Note: ¹ Underweight included with normal weight due to small numbers.

Table 3: Obesity and overweight by occupational group

Occupational group	Obese (BMI ≥ 30.00)			Overweight (BMI ≥ 25.00)		
	Weighted			Weighted		
	%	95% CI		%	95% CI	
		Lower	Upper		Lower	Upper
Nurses	25.12	20.88	29.37	60.79	56.02	65.57
Other healthcare professionals	14.39	11.00	17.77	49.00	44.18	53.82
Unregistered care staff	31.88	28.44	35.32	68.12	64.67	71.56
Non-health related occupations	23.51	22.92	24.10	62.54	61.86	63.21

Table 4: Binary logistic regression models

	Obese (BMI \geq 30.00)			
	Unweighted		Weighted	
	Unadjusted	Adjusted	Unadjusted	Adjusted
Occupational groups				
Nurse	Comparison	Comparison	Comparison	Comparison
Other health care professionals	0.53 (0.37-0.75)*	0.55 (0.39-0.77)*	0.50 (0.35-0.72)*	0.52 (0.37-0.75)*
Unregistered care staff	1.34 (1.02-1.75)*	1.40 (1.07-1.83)*	1.40 (1.06-1.84)*	1.46 (1.11-1.93)*
Non-health occupations	0.91 (0.73-1.13)	0.92 (0.73-1.15)	0.92 (0.73-1.15)	0.94 (0.74-1.18)
Survey year				
2008	Comparison	Comparison	Comparison	Comparison
2009	0.96 (0.85-1.07)	0.95 (0.85-1.07)	0.91 (0.81-1.02)	0.91 (0.81-1.02)
2010	1.11 (1.01-1.22)*	1.10 (1.00-1.20)	1.11 (1.02-1.21)*	1.10 (1.01-1.21)*
2011	0.97 (0.88-1.07)	0.96 (0.88-1.06)	0.95 (0.86-1.04)	0.93 (0.85-1.02)
2012	0.95 (0.87-1.05)	0.94 (0.85-1.03)	0.96 (0.87-1.05)	0.94 (0.86-1.03)
Gender				
Male	Comparison	Comparison	Comparison	Comparison
Female	0.92 (0.86-0.98)*	1.21 (1.05-1.39)*	0.93 (0.87-0.99)*	0.90 (0.84-0.96)*
Age				
≤ 29	Comparison	Comparison	Comparison	Comparison
30-34	1.21 (1.05-1.39)*	1.21 (1.05-1.39)*	1.26 (1.10-1.43)*	1.26 (1.10-1.43)*
35-39	1.65 (1.45-1.88)*	1.66 (1.45-1.89)*	1.78 (1.57-2.01)*	1.78 (1.58-2.02)*
40-44	1.74 (1.54-1.97)*	1.74 (1.54-1.97)*	1.83 (1.63-2.05)*	1.83 (1.63-2.05)*
45-49	2.10 (1.86-2.38)*	2.11 (1.87-2.39)*	2.30 (2.04-2.58)*	2.30 (2.05-2.59)*
50-54	2.32 (2.04-2.63)*	2.32 (2.04-2.63)*	2.54 (2.26-2.86)*	2.54 (2.25-2.86)*
55-59	2.43 (2.14-2.77)*	2.43 (2.13-2.77)*	2.55 (2.24-2.89)*	2.55 (2.25-2.90)*
≥ 60	2.21 (1.92-2.55)*	2.18 (1.89-2.51)*	2.33 (2.02-2.68)*	2.31 (2.00-2.66)*

Note: * $p < 0.05$

DISCUSSION

A quarter of nurses in England were obese (25.1%). Prevalence of obesity was lower compared to nurses in Australia (28.5%) (15), New Zealand (28.2%) (15), the United States of America (27.0%) (37), South Africa (51.6%) (38) and Scotland (29.4%) (11).

Obesity prevalence was especially high among older nurses. As almost half (47.1%) of English nurses are over the age of 45 (39), this poses a likely future burden of ill health for the healthcare workforce. Prevalence of obesity among nurses was statistically significantly higher than among other healthcare professionals such as allied health professionals who, although categorised in the same socio-economic classification, are less likely to work shifts and have disruptive working patterns which contribute to obesity. Prevalence of obesity among nurses was significantly lower than in unregistered care workers. This reflects population-level inequalities in obesity prevalence, where obesity is more common in people with low educational attainment, low income or in manual occupations (40–42).

There was no statistically significant difference between the prevalence of obesity among nurses and the general working population. The greater health literacy of nurses might be expected to contribute to lower rates of obesity than the general population but this study has shown that nurses are no more able to maintain a healthy weight than their age and gender related cohorts.

Implications for policy and practice

These findings on the prevalence of obesity have important implications for the health of the health and social care workforce, the effectiveness of health promotion delivered by healthcare professionals, and patient safety. Given the established link between obesity and increased risk of illness and injury, obesity among healthcare professionals potentially harms their health. Obese individuals may struggle with health issues associated with obesity, including fatigue, breathlessness, or arthritis which could reduce productivity in the workplace (43). Workforce capacity may be reduced through increased absenteeism and premature workforce exit (44). Together these two factors could increase the cost of service delivery considerably through sickness absence payments for existing staff, increased salary costs of temporary (agency) staff, increased training costs to replace staff, and the attendant loss of experience and expertise. The high prevalence of obesity among the healthcare workforce should urge policymakers and employers to provide solutions, such as supporting staff to maintain a healthy weight through workplace initiatives (45,46). Investment in staff health would in turn benefit the health service in terms of sustainability and high-quality patient care via positive impacts on productivity, retention and absence rates through improved morale, job satisfaction and wellbeing (47).

Obesity among healthcare professionals may hinder effective patient care through performance impairments that impact on patient safety. Nurses who are obese may experience considerable difficulty in carrying out certain physical aspects of patient care activities requiring access to tight spaces, range of motion and mobility, and may struggle to perform nursing tasks such as cardiopulmonary resuscitation (CPR),

moving and handling, and attending to patients’ personal care needs due to limited space in washrooms(48). Even physically fit nurses are at risk of workplace injury, and performing certain physical aspects of the nursing role while obese may further harm nurses’ health or increase the likelihood of injury, potentially leading to sickness absence or workforce exit. More research is required to assess the impact of obesity on nurses’ ability to physically and mentally perform their role.

This research has important implications for approaches to service design and workforce realignment, especially in the context of expanded roles for unregistered care workers in England (49) who were found to have the highest prevalence of overweight and obesity in our study. Urgent action from NHS England, involving Occupational Health (OH) and Human Resources (HR) departments across Trusts, is required to “put its own house in order” and reduce the prevalence of obesity among healthcare professionals that was found to be higher than published Department of Health estimates (50). Only through such concerted effort will the health service in England prevent the potentially harmful effects that high levels of obesity may have on patient care, the sustainability of the health service and – most importantly – the individual health of those who work within it.

Strengths and limitations

This is the first study to use the Health Survey for England to estimate prevalence of obesity among healthcare professionals. Data were drawn from a nationally representative sample of the English population which enhances generalisability. The height and weight measurements used to derive BMI were taken by nurses rather than self-reported which enhances reliability. However, the study does have

several limitations. First, BMI data for some participants (13.5%) were missing, although there was no statistically significant difference in the extent of missing data between occupational groups ($p=0.86$). Second, heterogeneity of roles and fields of practice within the nursing workforce is masked by the inability to differentiate within the single occupational classification of nurses. Third, there was no question about parental socio-economic status that might have enabled analysis of social mobility in contrast to work done elsewhere on nurses and weight that drew on the Scottish Health Survey (11). Fourth, ethnicity might also partially account for the high rates of obesity: obesity rates are 9% higher in Black women relative to White women and nearly 10% of the qualified nursing workforce identifies as Black or Black British (39) but the numbers included in the HSE were too small for confident analysis and to protect anonymity. Finally, for similar reasons it was not possible to investigate the responses of individuals to questions asked in the HSE about weight perceptions and intentions to lose weight and their measured BMI (51).

CONCLUSIONS

A quarter of nurses in England were obese ($\text{BMI} \geq 30$). Prevalence of obesity among nurses was statistically significantly higher than other healthcare professionals, but significantly lower than unregistered care workers. There was no statistically significant difference between levels of obesity among nurses and the general working population. Obesity among healthcare professionals has potentially negative implications for the capacity, efficacy, sustainability and safety of healthcare services and the health of healthcare professionals. Further research is required to better understand the reasons for high levels of obesity among healthcare professionals, especially nurses and unregistered care workers. Urgent action is

required to support healthcare professionals to achieve and maintain a healthy weight.

Contributors

RGK, IMA, JW designed the study. IMA conducted data analysis. RGK wrote the first draft of the manuscript and IMA, JW, CM, LH, MK revised the manuscript for important intellectual content. All authors approved the final version.

Conflict of interest statement

The authors confirm that there are no known conflicts of interest associated with this publication.

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Ethics committee approval

The study was reviewed and approved by the Research Ethics Committee at London South Bank University (UREC 1616) and the Research Integrity Committee in the School of Health & Social Care at Edinburgh Napier University (FHLSS/1664).

Data sharing statement

Health Survey for England data are available from NatCen Social Research.

REFERENCES

1. Logue J, Murray HM, Welsh P, Shepherd J, Packard C, Macfarlane P, et al. Obesity is associated with fatal coronary heart disease independently of traditional risk factors and deprivation. *Heart* [Internet]. 2011 Apr 1;97(7):564–8. Available from: <http://heart.bmj.com/cgi/doi/10.1136/hrt.2010.211201>
2. Renehan A, Tyson M, Egger M, Heller R, Zwahlen M. Body-mass index and incidence of cancer: a systematic review and meta-analysis of prospective observational studies. *Lancet*. 2008;371(9612):569–78.
3. Bell JA, Kivimaki M, Hamer M. Metabolically healthy obesity and risk of incident type 2 diabetes: a meta-analysis of prospective cohort studies. *Obes Rev* [Internet]. 2014 Jun;15(6):504–15. Available from: <http://doi.wiley.com/10.1111/obr.12157>
4. Reed LF, Battistutta D, Young J, Newman B. Prevalence and risk factors for foot and ankle musculoskeletal disorders experienced by nurses. *BMC Musculoskelet Disord* [Internet]. 2014 Dec 5;15(1):196. Available from: <http://bmcmusculoskeletdisord.biomedcentral.com/articles/10.1186/1471-2474-15-196>
5. Wang YC, McPherson K, Marsh T, Gortmaker SL, Brown M. Health and economic burden of the projected obesity trends in the USA and the UK. *Lancet* [Internet]. 2011 Aug;378(9793):815–25. Available from: <http://linkinghub.elsevier.com/retrieve/pii/S0140673611608143>
6. Dobbs R, Sawers C, Thompson F, Manyika J, Woetzel JR, Child P, et al. Overcoming obesity: an initial economic analysis. 2014.
7. Ng M, Fleming T, Robinson M, Thomson B, Graetz N, Margono C, et al. Global, regional, and national prevalence of overweight and obesity in children

and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet* [Internet]. 2014 Aug;384(9945):766–81. Available from: <http://linkinghub.elsevier.com/retrieve/pii/S0140673614604608>

8. Moody A, Neave A. Health Survey for England 2015. Adult overweight and obesity [Internet]. London; 2016. Available from: <http://www.content.digital.nhs.uk/catalogue/PUB22610/HSE2015-Adult-obe.pdf>

9. Butland B, Jebb S, Kopelman P, McPherson K, Thomas S, Mardell J, et al. Foresight. Tackling obesities: future choices. Project report. London, UK; 2007.

10. Department of Health. Healthy Weight, Healthy Lives: One Year On. London; 2009.

11. Kyle RG, Neall RA, Atherton IM. Prevalence of overweight and obesity among nurses in Scotland: A cross-sectional study using the Scottish Health Survey. *Int J Nurs Stud* [Internet]. Elsevier Ltd; 2016;53:126–33. Available from: <http://linkinghub.elsevier.com/retrieve/pii/S0020748915003326>

12. Studnek JR, Bentley M, Mac Crawford J, Fernandez AR. An Assessment of Key Health Indicators among Emergency Medical Services Professionals. *Prehospital Emerg Care* [Internet]. 2010 Jan 30;14(1):14–20. Available from: <http://www.tandfonline.com/doi/full/10.3109/10903120903144957>

13. Holman GT, Thomas RE, Brown KC. A health comparison of Alabama nurses versus US, UK, and Canadian normative populations. *J Orthop Nurs* [Internet]. Elsevier Ltd; 2009;13(4):172–82. Available from: <http://dx.doi.org/10.1016/j.joon.2009.03.005>

14. Zapka J, Lemon SC, Magner R, Hale J. Lifestyle behaviours and weight among hospital-based nurses. *J Nurs Manag* [Internet]. 2009 Nov [cited 2014 Dec 11];17(7):853–60. Available from:

- 1
2
3 <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2760042&tool=pmc>
4
5 [entrez&rendertype=abstract](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2760042&tool=pmc)
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41
42
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44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
15. Bogossian FE, Hepworth J, Leong GM, Flaws DF, Gibbons KS, Benefer C a., et al. A cross-sectional analysis of patterns of obesity in a cohort of working nurses and midwives in Australia, New Zealand, and the United Kingdom. *Int J Nurs Stud* [Internet]. Elsevier Ltd; 2012;49(6):727–38. Available from: <http://dx.doi.org/10.1016/j.ijnurstu.2012.01.003>
16. Anandacoomarasamy A, Caterson I, Sambrook P, Fransen M, March L. The impact of obesity on the musculoskeletal system. *Int J Obes* [Internet]. 2008 Feb 11;32(2):211–22. Available from: <http://www.nature.com/doi/10.1038/sj.ijo.0803715>
17. Luppino FS, de Wit LM, Bouvy PF, Stijnen T, Cuijpers P, Penninx BWJH, et al. Overweight, Obesity, and Depression. *Arch Gen Psychiatry* [Internet]. 2010 Mar 1;67(3):220. Available from: <http://archpsyc.jamanetwork.com/article.aspx?doi=10.1001/archgenpsychiatry.2010.2>
18. Mather AA, Cox BJ, Enns MW, Sareen J. Associations of obesity with psychiatric disorders and suicidal behaviors in a nationally representative sample. *J Psychosom Res* [Internet]. 2009 Apr;66(4):277–85. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/19302884>
19. Health and Safety Executive. Labour Force Survey - Self-reported work-related ill health and workplace injuries [Internet]. Labour Force Survey. 2016 [cited 2017 Aug 8]. Available from: <http://www.hse.gov.uk/statistics/lfs/index.htm>
20. Nicholls R, Perry L, Duffield C, Gallagher R, Pierce H. Barriers and facilitators to healthy eating for nurses in the workplace: An integrative review. *J Adv*

Nurs. 2016;(September):1–15.

21. Peplonska B, Bukowska A, Sobala W. Association of rotating night shift work with BMI and abdominal obesity among nurses and midwives. PLoS One. 2015;10(7):1–13.

22. Wong H, Wong MCS, Wong SYS, Lee A. The association between shift duty and abnormal eating behavior among nurses working in a major hospital: a cross-sectional study. Int J Nurs Stud [Internet]. Elsevier Ltd; 2010 Aug [cited 2014 Dec 11];47(8):1021–7. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/20116059>

23. Amani R, Gill T. Shiftworking, nutrition and obesity: implications for workforce health- a systematic review. Asia Pac J Clin Nutr [Internet]. 2013 Jan [cited 2016 Apr 26];22(4):505–15. Available from: <http://www.scopus.com/inward/record.url?eid=2-s2.0-84890096822&partnerID=tZOtx3y1>

24. Schulte PA, Wagner GR, Ostry A, Blanciforti LA, Cutlip RG, Krajnak KM, et al. Work, Obesity, and Occupational Safety and Health. Am J Public Health [Internet]. 2007 Mar;97(3):428–36. Available from: <http://ajph.aphapublications.org/doi/10.2105/AJPH.2006.086900>

25. Fujishiro K, Lawson CC, Hibert EL, Chavarro JE, Rich-Edwards JW. Job strain and changes in the body mass index among working women: a prospective study. Int J Obes [Internet]. 2015 Sep 19;39(9):1395–400. Available from: <http://www.nature.com/doi/10.1038/ijo.2015.91>

26. Health and Social Care Information Centre. NHS Workforce Statistics - April 2016, Provisional statistics [Internet]. NHS Workforce Statistics. 2016 [cited 2016 Jul 29]. Available from:

- 1
2
3 <http://www.hscic.gov.uk/catalogue/PUB21066/nhs-work-stat-apr-2016-pdf.pdf>
4
5
6 27. World Health Organisation. The 2014 update, Global Health Workforce
7
8 Statistics [Internet]. Geneva, Switzerland; 2014. Available from:
9
10 <http://apps.who.int/gho/data/node.main?showonly=HWF>
11
12 28. Marshall LC. Teachable moments. Nurs Manage [Internet]. 2016
13
14 May;23(2):13. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/27138503>
15
16 29. NHS England. NHS Standard Contract 2017/18 and 2018/19 Service
17
18 Conditions [Internet]. London, UK; 2016. Available from:
19
20 [https://www.england.nhs.uk/wp-content/uploads/2016/11/2-service-conditions-](https://www.england.nhs.uk/wp-content/uploads/2016/11/2-service-conditions-fl.pdf)
21
22 [fl.pdf](https://www.england.nhs.uk/wp-content/uploads/2016/11/2-service-conditions-fl.pdf)
23
24
25 30. Curtice J. Attitudes to obesity. Findings from the 2015 British Social Attitudes
26
27 survey [Internet]. London, UK; 2016. Available from:
28
29 <http://www.bsa.natcen.ac.uk/media/39132/attitudes-to-obesity.pdf>
30
31
32 31. Kelly M, Wills J, Jester R, Speller V. Should nurses be role models for healthy
33
34 lifestyles? Results from a modified Delphi study. J Adv Nurs [Internet]. 2017
35
36 Mar;73(3):665–78. Available from: <http://doi.wiley.com/10.1111/jan.13173>
37
38
39 32. Kelly M, Sykes S, Wills J. Do healthcare professionals' own health behaviours
40
41 impact on patient outcomes? A systematic review. 2017;
42
43 33. Fie S, Norman IJ, While AE. The relationship between physicians' and nurses'
44
45 personal physical activity habits and their health-promotion practice: A
46
47 systematic review. Health Educ J [Internet]. 2012 Jan 11 [cited 2014 Dec
48
49 11];72(1):102–19. Available from:
50
51 <http://hej.sagepub.com/cgi/doi/10.1177/0017896911430763>
52
53
54 34. Lobelo F, de Quevedo IG. The Evidence in Support of Physicians and Health
55
56 Care Providers as Physical Activity Role Models. Am J Lifestyle Med [Internet].
57
58
59
60

Global Health Promotion Office, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Atlanta, Georgia.: SAGE Publications; 2016 Jan;10(1):36–52. Available from: <http://search.ebscohost.com/login.aspx?direct=true&db=cmedm&AN=26213523&site=ehost-live>

35. NatCen Social Research and UCL. Health Survey for England 2012: User Guide, London, NatCen Social Research. <http://doc.ukdataservice.ac.uk/doc/7480/mrdoc/pdf/7480userguide.pdf> [last accessed 11 August 2017].

36. Rose D, Pevalin D, O'Reilly K. The National Statistics Socio-economic Classification: Origins, Development and Use. Basingstoke, UK: Palgrave Macmillan; 2005.

37. Zitkus BS. The relationship among registered nurses' weight status, weight loss regimens, and successful or unsuccessful weight loss. J Am Acad Nurse Pract [Internet]. 2011 Feb [cited 2014 Dec 11];23(2):110–6. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/21281377>

38. Goon D, Maputle MS, Olukoga A, Lebesse R, Khoza LB, Ayanwu FC. Overweight, obesity and underweight in nurses in Vhembe and Capricorn districts, Limpopo. South African J Clin Nutr. 2013;26(3):147–9.

39. NHS Digital. HCHS staff in NHS Trusts and CCGs in England, Equality and Diversity Tables, March 2016 [Internet]. 2016. Available from: <https://digital.nhs.uk/article/2021/Website-Search?productid=21281>

40. Loring B, Robertson A. Obesity and inequities: guidance for addressing inequities in overweight and obesity. [Internet]. Copenhagen; 2014. Available from: http://www.euro.who.int/__data/assets/pdf_file/0003/247638/obesity-

- 090514.pdf
41. Swinburn BA, Sacks G, Hall KD, McPherson K, Finegood DT, Moodie ML, et al. The global obesity pandemic: shaped by global drivers and local environments. *Lancet*. 2011;378(9793):804–14.
 42. Moody A, Neave A. Health Survey for England 2015. Adult overweight and obesity [Internet]. London, UK; 2016. Available from: <http://content.digital.nhs.uk/catalogue/PUB22610/HSE2015-Adult-obe.pdf>
 43. Finkelstein EA, Linnan LA, Tate DF, Leese PJ. A longitudinal study on the relationship between weight loss, medical expenditures, and absenteeism among overweight employees in the WAY to Health study. *J Occup Environ Med* [Internet]. Lippincott Williams & Wilkins; 2009 Dec;51(12):1367–73. Available from: <http://search.ebscohost.com/login.aspx?direct=true&db=cmedm&AN=19952786&site=ehost-live>
 44. Kouwenhoven-Pasmooij TA, Burdorf A, Roos-Hesselink JW, Hunink MGM, Robroek SJW. Cardiovascular disease, diabetes and early exit from paid employment in Europe; the impact of work-related factors. *Int J Cardiol* [Internet]. 2016 Jul 15;215:332–7. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/27128556>
 45. Stevens S. Get serious about obesity or bankrupt the NHS [Internet]. NHS England. 2014. Available from: <https://www.england.nhs.uk/2014/09/serious-about-obesity/>
 46. NHS England, Care Quality Commission, Health Education England, Monitor, Public Health England, Trust Development Authority. NHS five year forward view [Internet]. London: NHS England; 2014. Available from:

1
2
3 <http://www.england.nhs.uk/ourwork/futurenhs/>
4
5 47. The Royal College of Physicians. Work and wellbeing in the NHS: why staff
6 health matters to patient care. Setting higher standards. London, UK; 2015.
7
8
9 48. Krussig K, Willoughby D, Parker V, Ross P. Obesity Among Nurses:
10 Prevalence and Impact on Work. *Am J Nurse Pract.* 2012;16(7/8):14–21.
11
12 49. Health Education England. Nursing Associate - a new support role for nursing
13 [Internet]. 2016 [cited 2017 Jun 6]. Available from: <http://tinyurl.com/zqbmeko>
14
15 50. Cross-Government Obesity Unit. Healthy weight, healthy lives: One year on.
16
17 London, UK; 2009.
18
19 51. Robinson, E. and Oldham, M., 2016. Weight status misperceptions among UK
20 adults: the use of self-reported vs. measured BMI. *BMC Obesity*, 3(1), .21.
21
22
23
24
25
26
27
28
29
30
31
32
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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract	1, 2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2,3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	4
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	5-6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5-6
Bias	9	Describe any efforts to address potential sources of bias	6
Study size	10	Explain how the study size was arrived at	7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-7
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	6-7
		(b) Describe any methods used to examine subgroups and interactions	6-7
		(c) Explain how missing data were addressed	6-7
		(d) If applicable, describe analytical methods taking account of sampling strategy	6-7
		(e) Describe any sensitivity analyses	6-7
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7
		(b) Give reasons for non-participation at each stage	7
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	7, 19
		(b) Indicate number of participants with missing data for each variable of interest	7
Outcome data	15*	Report numbers of outcome events or summary measures	7-8
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	20
		(b) Report category boundaries when continuous variables were categorized	5-6
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	8
Discussion			
Key results	18	Summarise key results with reference to study objectives	8
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	11-12
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	9-11
Generalisability	21	Discuss the generalisability (external validity) of the study results	9-11
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	13

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.